Unit 13

SOUND

Q. What is sound?

Ans. Sound is a form of energy which is produced due to vibration of a body.

Q. How sound is produced?

Ans. Sound is produced due to vibration of a body, whenever a sound is produced, the vibrations of the sounding body can be observed or felt.

EXAMPLES

Place a pan upside down by touching the pan on a table and strike it with a spoon, its vibrations can be felt by touching the pan. Moreover we can also see the vibrations of the pan by placing small pieces of paper on it. They will also start vibrating with the pan.

2- Tuning fork.

Tuning fork is used in laboratory for producing sound of particular frequency. A tuning fork is a 'U' shaped having two metal prongs with a stem at the bottom. When it strikes against the rubber pad it will began to vibrate, and a sound is produced. Its vibrations can be felt by touching the prongs.

If we put the ends of prongs in water we will see water is splashing. The splashing is due to vibration of prong.

CONCLUSION:

This shows that sound is produced due to vibrations of body, which we can feel or observe.

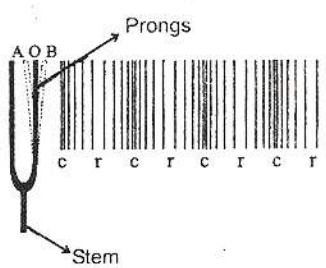
Q What is nature of sound? Show by experiment that a material medium is needed for the propagation of sound.

Ans. Nature of Sound:

Sound is produced due to vibration. During vibration vibrating body moves to and fro around its mean position and produces compressional waves. Which are called sound waves.

MOVEMENTOF COMPRESSIONAL WAVES:

When we strike the tuning fork against the rubber pad it will start vibrate and a sound is produced. The prongs of tuning fork will start vibrate between A and B.



COMPRESSION:

When the prong of tuning fork moves from A to B, it compress the layer of air in front of it. The compressed layer now transfer its pressure to the next layer. This process goes on and compression produced by right ward movement of prong.

RAREFACTION:

When the prong moves from B to A, The Pressure on adjacent layer decreases and rarefaction produced this rarefaction which is produced transfer its decrease in pressure to the next layer and then comes to its normal state. This process goes on and the rarefaction produced in the first layer moves out ward.

As the tuning fork continues to vibrate and travel out-ward one after the other such series of compression and rarefaction are called sound waves.

SOUND AS COMPRESSIONAL WAVES:

Since molecules of air move in the direction of waves during vibration of body. We can say sound waves are compressional waves.

(b) SOUND WAVES NEEDS MATERIAL MEDIUM FOR PROPAGATION.

Sound waves can travel through air, gases or liquids.

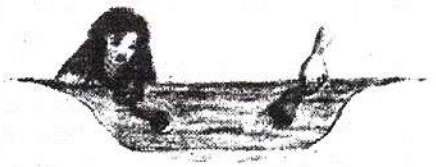
EXPERIMENT-1:

Place a bell jar on the plate form of a vaccum pump. An electric bell is suspended with the help of two wires which pass through a cork fixed in the mouth of jar. On connecting the wires with battery, the bell will start ringing, and we can hear its sound. Now start pumping out air from the jar by means of vaccum pump. The sound of bell starts becoming feeble. At last sound of bell becomes hardly audible inspite of the fact that hammer is striking the bell. But when we let air into jar. We can hear sound of bell again.

CONCLUSION:

We can conclude that presence of air is necessary for the propagation of sound i.e. a medium is required.

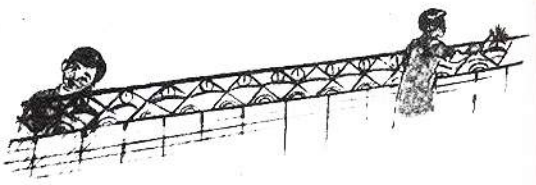
SOUND CAN TRAVEL THROUGH WATER:



Ring the bell inside the water. At some distance from the bell suspend stethoscope in water in such a way that its detector faces the bell the sound of the bell will be heard very clearly through the stethoscope.

CONCLUSION: This show that sound can pass through water.

SOUND CAN TRAVEL THROUGH SOLID:



Strike one end of long railing with a hammer your friend standing near the other end of the railing will be able to hear the sound clearly on bringing his ear near the railing. If the railing is long, he will hear two sounds one through the railing and a moment later a second one through air. This shows that speed of sound in solid is greater than in air.

CONCLUSION:

We can observe from these experiments that

1. A material medium is necessary for propagation of sound.
2. Sound can travel through gases liquid and solids.
3. Speed of sound in solid is greater than in air.

Q. a) Name the Organ of Hearing.

b) Describe the Structure of Ear.

c) Describe the process of Hearing. Or How can we detect the sound by EAR?

Ans. Ear is an organ of hearing.

Structure of Ear:

Ear has three parts.

1- Outer Ear **2-** Middle Ear **3-** Inner Ear

1. Outer Ear:

The horn like part of ear which is visible from outside is called outer ear.

Ear Drum:

Near its centre there is an open canal, which ends at a diaphragm called eardrum. The external ear collects the sound waves and directs them to the ear drum, the sound waves reach the air drum and make it to vibrate.

2. Middle Ear:

The eardrum separates the outer ear from middle ear. The middle ear is a small, irregular cavity the wall of middle ear opposite to ear drum has a small opening called oval window.

Stretching across the middle ear from the eardrum to the oval window, there are three tinny, moveable bones, which are:

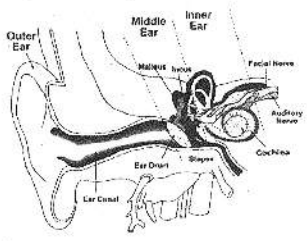
1- Hammer 2- Anvil 3- Stirrup

The sound waves reaching the eardrum make it vibrate. The feeble vibration of the eardrum is conveyed to the inner ear through the chain of these bones and oval window.

3. Inner Ear:

Inner structure of ear is quite complicated, but its part which plays an important role in hearing is called cochlea.

COCHLEA:



Its shape is like a snail and is filled with jelly like fluid. There are countless hair like structures in cochlea which are in fact the ending of the fibers of the auditory nerves. These nerves are connected to the brain. Vibrations produced by the sound waves reach the inner ear through the oval window and the pressure of the liquid in it changes accordingly. The hair like parts present in cochlea respond to different frequencies of vibrations. They stimulate and start sending impulses through auditory nerve to the brain. Where these messages are interpreted as the feeling of sound.

Q. Name the characteristics of Sound and explain them. (G-I/2006)

Ans. There are five characteristics of Sound.

(1) Loudness of sound (2) Intensity of sound (3) Pitch of sound
(4) Quality of Sound (5) Noise and Music

Q. What is meant by Loudness of sound? Also write the factors on which loudness of sound depends. (G-II/2006)

Ans. (1) LOUDNESS OF SOUND:

The characteristic of sound through which a loud and faint sound can be distinguished is called loudness. The loudness of sound depends upon.

(i) The amplitude of the vibrating body. (ii) Area of vibrating body
(iii) Distance from vibrating body.

(i) Amplitude:

If the amplitude of the vibrating body is large, the sound produced will be louder. The sound will be faint if the amplitude is small.

Example: The sound produced by sitar is loud if its wires are plucked violently.

When we beat drum forcefully, its membrane vibrates with large amplitude and loud sound is produced.

(ii) Area of Vibrating Body:

Larger the area of vibrating body louder sound is produced.

Examples:

(i) Strike a tuning fork on rubber pad it begins to vibrate and a feeble sound is heard. If it is placed on table vertically, the sound becomes louder, because the tabletop also begins to vibrate along with tuning fork and hence the total vibrating area increases.

(ii) Similarly the sound produced by a large drum is louder than that by a small one of the large vibrating area of big drum.

(iii)Distance from vibrating body:

Greater the distance of the listener from vibrating body, fainter is the sound.

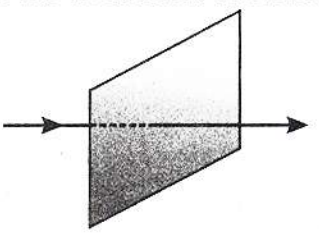
Loudness of sound is more if the distance between the listener and vibrating body is less.

Other Factors:

Loudness of a sound also depends upon the physical condition of ear of listener. A sound appears to be louder to a person with sensitive ear than to man with defective ear.

(2) INTENSITY OF SOUND:

Sound energy flowing per second through a unit area held perpendicular to the direction of sound wave is called intensity of sound.



UNIT:

Its unit is watt per meter square Wm^{-2}. It is a physical quantity and can be measured accurately.

intensity of faintest sound and louder sound:

(1) The intensity of faintest sound is 10^{-12} Wm^{-2}.

(2) The intensity of loudest sound which can be heard without pain is 1 Wm^{-2}

Intensity and loudness of sound:

Intensity of sound is physical quantity and it does not depend upon the condition or sensitiveness of ear:

Loudness:

The magnitude of the sensation produced on the ear by a sound is called its loudness. The loudness of a sound depends not only on the intensity of sound, but also depends upon the physical condition of ear.

Weber Fechner's Law: (L. B '08)

For human ear, loudness of sound is not directly proportional to its intensity, but it is directly proportional to the logarithm of intensity. Or loudness of sound is directly proportional to the logarithm of Intensity of sound.

Mathematically:

$L \propto \log I$

$L = K \log I$ ----------(1)

Where 'K' is constant of proportionality.

If L_o represent the loudness of the faintest audible sound of intensity I_o and L is loudness of an unknown sound of intensity I, then above equation can be written as.

$L_o = k \log I_o$ ----------(2)

Subtracting (1) and (2)

$L - L_o = K \log I - k \log I_o$

$= k (\log I - \log I_o)$

$$L - L_o = k \log \frac{I}{I_o}$$

Sound level or intensity level:

The difference between the loudness of two sound $(L - L_o)$ is called intensity level or sound level.

$$\text{Intensity level} = L - Lo = k \log \frac{I}{I_o} \quad \text{----------(3)}$$

Value of K:

The value of k depends upon the unit of I and I_o and on unit of intensity level. If the intensity I of any unknown sound is 10 times greater than the intensity I_o of the faintest audible sound.

i.e. $I = 10I_o$, and

Intensity level of this sound is taken as unit, called bels. Then value of K is 1.

put $K = 1$' in eq. (3)

$$\text{Sound level} = \log \frac{I}{I_o} \text{ (bels)} \quad \text{----------(4)}$$

Unit of Sound Level:

Bel is the unit of sound level. This unit is larger.

Smaller unit is decibel

1 bel = 10 dB.

So eq. 4 becomes

$$\text{Sound level} = 10 \log \frac{I}{I_o} \text{ (dB)}$$

To understand decibel scale we calculate the intensity level of different sounds.

Intensity level of Faintest Sound:

Intensity level of faintest sound is calculated by putting.

$$I = I_o = 10^{-12} \text{ Wm}^{-2}$$

$$\text{Intensity level} = 10 \log \frac{I}{I_o} \text{ dB}$$

$$= 10 \log \frac{10^{-12}}{10^{-12}} = \text{OdB}$$

Intensity level of rustle of Leaves = $I = 10^{-11}$ Wm^{-2}

$$I_o = 10^{-12} \text{ Wm}^{-2}$$

$$= 10 \log \frac{10^{-11}}{10^{-12}} \text{ (dB)}$$

$$= 10 \log 10^{-11+12} \text{ dB}$$

$$= 10 \log 10 \text{ dB}$$

$$= (10 \text{ dB})$$

Intensity level of whispering = $I = 10^{-10}$ W/m^{-2}

$$L - L_o = 10 \log \frac{10^{-10}}{10^{-12}} \text{ dB}$$

$$= 10 \log 10^2 \text{ dB}$$

$$= 2 \times 10 \log 10 \text{ dB}$$

$$= 20 \text{ (dB)}$$

(3) PITCH OF SOUND: **(L. B '08)**

The characteristic of sound by which a shrill sound can be distinguished from a grave sound is called pitch. Pitch of sound depends upon frequency.

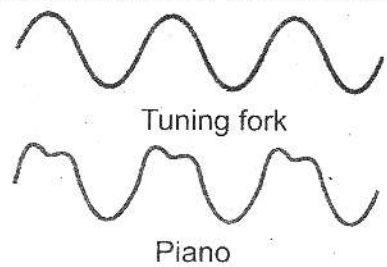
FACTORS:

Greater the frequency, higher is the pitch smaller frequency smaller is the pitch.

The frequency of the voice of ladies and babies is greater than that of men. Hence their voice is shrill and of high pitch.

EXPERIMENT:

Support a bicycle on its stand and rotate its rear wheel. Hold a cardboard with its free end touching the spokes of the rotation of the wheel. Due to vibration of sound, you will hear a grave sound. Now increase the speed of wheel. The vibration of cardboard will be come quicker and frequency will increase. You will notice that the sound produced will shrill.



QUALITY OF SOUND:

The characteristic of sound by which two sounds of same loudness and pitch are distinguished from each other is called quality of sound.

Example:

If in a room a note of given loudness and pitch is sounded on a flute and also on a piano, we can distinguish between them by standing even outside the room, because quality of these notes is different.

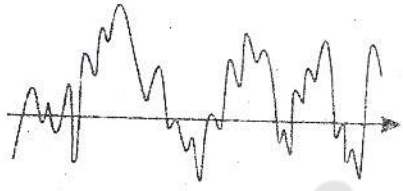
Above waveform of the sound produced by tuning fork and that produced by a piano. Their pitch and loudness is same but their waveform is different, hence their quality is different.

MUSICAL SOUND:

The sound which have pleasing effect on our ear is called musical sound. The frequency and amplitude of the musical sound change in regular manner.

NOISE:

The sound which has jarring effect on our ear is called noise. The frequency and amplitude of noise does not change in regular manners.

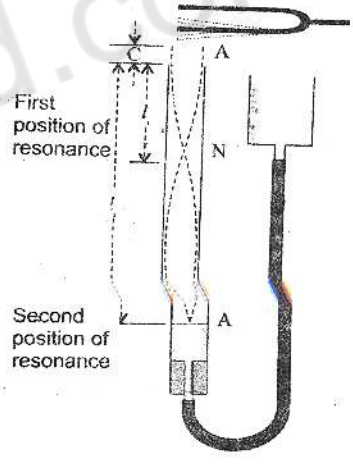


Q. Explain in detail the Laboratory Method to find speed of sound.

Ans. We can determine the speed of sound in the laboratory by resonance method. The apparatus consists of long tube which is connected to a water reservoir. By moving the reservoir up and down the length of air column can be changed.

Air Column and Tuning Fork:

Hold a vibrating tuning fork horizontally over the open end of a glass tube. The tuning fork forces the air columns in the tube to vibrate. Starting from a small length of the air column increase its length. For a certain length of the air column the sound of the tuning fork becomes loudest. At this position the air columns resonates with tuning fork frequency. In other words, the tuning fork and the air column vibrate with same frequency.



Resonance:

The phenomenon in which there is a remarkable increase in the amplitude and hence the loudness of sound when the frequency of air column becomes equal to that of tuning fork, is called resonance.

When a tuning fork vibrates near the edge of the tube, it starts sending the compressional waves. These waves, when strike the water surface, are reflected. These reflected waves and incoming waves produce stationary waves in state of resonance. There will be an antinode at the open end of the tube and the node at the other end. Since the distance between a node and next antinode is equal to one quarter of wavelength. Hence we can write following equation for stationary waves, which appears in the vibrating, air columns.

$$\frac{\lambda}{4} = \ell \quad \text{or} \quad \lambda = 4\,\ell$$

If f is the frequency of the tuning fork, then speed v of the sound can be found by using.

$$V = f\lambda$$

since $\lambda = 4\ \ell$

hence $v = 4f\ \ell$

Where λ is wavelength of the stationary waves and is equal to four times of the measured length of air column in first position of resonance.

Q. Describe audible frequency range.

Ans. **Audible Frequency Range:** **(L. B '07)**

We know that sound is produced by a vibrating body. A simple pendulum also vibrates but it does not produce any sound. The reason is that its vibrations are very slow.

Frequency Range:

A human ear can hear a sound only if its frequency lies between 20 Hz to 20,000 Hz.

In other words a human ear neither can hear a sound of frequency less than 20 Hz and nor a sound of frequency beyond 20,000 Hz. Sounds of frequency beyond 20,000 Hz are inaudible because the eardrum cannot vibrate so rapidly. The audible frequency range differs a little for different persons. The above mentioned audible frequency range is only an average. It also decreases with age. Young children can hear sounds of 20,000 Hz frequency but old people cannot hear sounds even above 15,000 Hz frequency.

Q. Define ultrasonics and write their uses. (L. B '10)

Ans. Sounds of frequency higher than 20,000 Hz which are inaudible to human ear can be produced and are utilized in many useful ways. Such sounds are called ultrasonics.

Characteristics:

It has been seen that ultrasonic waves carry more energy than audible sound waves. Moreover according to the relation $v = f\lambda$ the wavelength of ultrasonic waves is very small. Due to these characteristics ultrasonics are usefully utilized in medical and technical fields.

Use in medical field:

1) In medical field ultrasonic waves are being used to diagnose and treat different ailments.

2) For diagnosis of different diseases ultrasonic waves are made to enter the human body. These waves are reflected differently by different organs, tissues, benign or malignant tumors. The reflected ultrasonic waves are then amplified and fed to a monitor which forms an image of the internal organs of the body on its screen. Such an image helps in detecting the defects of these organs.

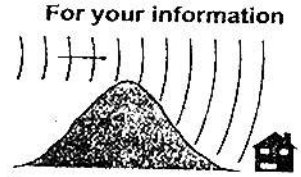
3) Now-a-days ultrasonic waves are used not only to find the sex of a baby but also to find its physical abnormalities before birth in the womb of the mother.

4) Powerful ultrasonics are now being used to remove blood clots formed in the arteries.

Use in technical field:

Due to excessive use cracks appear in the interior of the moving parts of high speed heavy machines such as turbines engines of ships and aeroplanes. These cracks are not visible from outside but they can be very dangerous. Such cracks can be detected by ultrasonics. A powerful beam of ultrasonics is made to pass through these defective parts. While passing these waves are reflected by the surface of these cracks and flaws. The comparison of the ultrasonic waves reflected

For your information



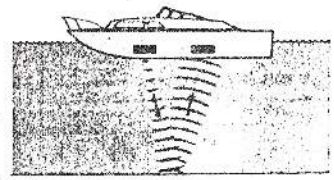
The resources of oil and gas beneath the Earth are searched by using ultrasonics.

from the cracks and from the other surfaces of these parts can give a clue of the existence of the cracks.

To find depth of Sea:

The depth of an ocean can be measured by using ultrasonics. An ultrasonic pulse is sent down towards the ocean bed from the bottom of a ship. This pulse, after reflection from the ocean bed, reaches the ship where it is detected. The time taken by the ultrasonic pulse in traveling from the ship to the ocean bed and back to the ship is measured. Using this time and the speed of sound in water the depth of the ocean can be determined.

Do you know ?



The depth of an ocean is measured by using ultrasonics.

To kill germs:

Germs and bacteria in liquids can be destroyed by using high intensity ultrasonic waves.

Scaling of Teeth:

Ultrasonic waves are used for the scaling of teeth, as their vibrations are so intense that they remove easily the dirt and plaque sticking to the teeth.

Removal of Kidney Stones:

The kidney stones can be crushed and removed out through urine with the help of ultrasonic waves without any surgery.

NUMERICAL PROBLEMS

13.1: If the intensity of sound is 1 Wm^{-2}. Calculate its sound level in decibel scale if the intensity of threshold of hearing is 10^{-12} Wm^{-2}. (L. B '06, 10)

Solution:

The given data is

Intensity = $I = 1\ Wm^{-2}$

Intensity of faintest audible sound = $I_0 = 10^{-12}\ Wm^{-2}$

Formula:

$$\text{Sound level} = 10 \times \log \frac{I}{I_0}\ dB$$

Putting value, we get

$$\text{Sound level} = 10 \times \log \frac{1}{10^{-12}}\ (dB)$$

$$= 10 \log 10^{12}\ dB$$

$$= 10 \times 12 \times \log 10\ (dB)$$

$$= 10 \times 12 \times 1\ (dB)$$

$$= 120\ (dB)$$

13.2: The sound of a gun is heard 2 seconds after its flash is seen. Calculate the distance of the gun from the listener. The speed of sound is 340ms^{-1}.

(G-II/2006, G-I/2007)

Solution:

The given data is

Time interval $t = 2$ s

Distance covered = S = ?

Speed of sound = V = 340 ms^{-1}

Formula:

Distance = velocity × time interval

Putting values, we get

Distance = (340) × (2)

$\boxed{s = 680 \text{ m}}$

13.3: A vibrating tuning fork of frequency 256 Hz is held over the top of a vertical tube full of water. The water is allowed to flow out slowly from the tube and a loud sound is heard when the air column in the tube is 33 cm.

Calculate the speed of Sound.

Solution:

The given data is

Frequency = f = 256 Hz

Length of air column = ℓ = 33cm = 0.33 m

Speed of Sound = V = ?

Formulas:

$V = f\lambda$

$\ell = \frac{\lambda}{4}$

For first resonance $\ell = \frac{\lambda}{4}$ OR $\lambda = 4\ \ell$

So, putting this value in the formula we get

$V = (f)\ (4\ \ell)$

$V = (256) \times 4 \times (0.33)$

$\boxed{V = 338 \text{ ms}^{-1}}$

13.4: Calculate the wavelength of sound produced by a tuning fork of frequency 512 Hz, whereas the speed of sound is 340ms^{-1}. (G-II/2007)

Solution:

The given data is

Wave length = λ = ?

Frequency = f = 512 Hz

Speed of sound = V = 340 ms^{-1}

Formula:

$$V = f\lambda$$

$$\lambda = \frac{v}{f}$$

Putting value in this formula, we get

$$\lambda = \frac{340}{512}$$

$$\lambda = 0.66 \text{ m} = 66 \text{ cm}$$

$$\boxed{\lambda = 66 \text{ cm}}$$

Multiple Choice Questions

Q. Circle the correct answer.

1. Sounds are produced by.
a) by silent b) vibrating body
c) by movement of body
d) by circulating body

2. We can heard sounds by:
a) eyes b) nose
c) ear d) skin

3. Tuning fork have prongs:
a) 1 b) 2
c) 3 d) 4

4. Sound waves can pass through:
a) gas b) solids
c) liquid d) All of these

5. Due to the vibration of tuning fork are produced:
a) compressions b) rarefactions
c) both a, b d) transverse waves

6. The structure of ear consists of
a) external ear b) middle ear
c) internal ear d) all of these

7. In middle ear moving bones are:
a) 3 b) 4
c) 2 d) 1

8. The loudness of sound depends upon the____ of vibrating body.
a) Amplitude
b) area of surface
c) distance of the body
d) all of these

9. The intensity of faintest sound is:
a) 10^{-12} Wm^{-2} b) 10^{-10} Wm^{-2}
c) 10^{-8} Wm^{-2} d) 10^{-6} Wm^{-2}

10. In the internal ear we can hear sound by:
a) Hammer b) Cochlea
c) Anvil d) Strip

11. The loudest sound which produces pain in the ear have intensity.
a) $1\,Wm^{-2}$ b) $2\,Wm^{-2}$
c) $3\,Wm^{-2}$ d) $4\,Wm^{-2}$

12. There are characteristics of musical sound:
a) 2 b) 3
c) 4 d) 5

13. According to Weber Fechner Loudness is proportional to:
a) log I b) log I_o
c) log $\frac{I}{I_o}$ d) intensity

14. The intensity of heavy traffic on road is:
a) $10^{-4}\,Wm^{-2}$ b) $10^{-5}\,Wm^{-2}$
c) $10^{-3}\,Wm^{-2}$ d) 10^{-2} Wm^{-2}

15. The sound level of heavy traffic on road is:
a) 80 dB b) 90 dB
c) 100 dB d) 120dB

16. The intensity of average whispering is:
a) 10^{-8} Wm^{-2} b) 10^{-10} Wm^{-2}
c) 10^{-6} Wm^{-2} d) 10^{-4} Wm^{-2}

17. The intensity level of faintest sound which we can hear is is
a) 10 dB b) 5 dB
c) 0 dB d) 4 dB

18. The intensity of rustle of leaves is:
a) 10^{-10} Wm^{-2} b) 10^{-11} Wm^{-2}
c) 10^{-12} Wm^{-2} d) 10^{-14} Wm^{-2}

19. The sound level of rustle of leaves is:
a) 10 dB b) 5 dB
c) 15 dB d) 20 dB

20. The sound which has intensity level 130dB has intensity:
a) 10^{-5} Wm^{-2} b) 10^{-4} Wm^{-2}
c) 10^{1} Wm^{-2} d) 10^{-2} Wm^{-2}

21. The sound which have sound level 40 dB has intensity:
a) 10^{-12} Wm^{-2} b) 10^{-11} Wm^{-2}
c) 10^{-8} Wm^{-2} d) 10^{-9} Wm^{-2}

22. The sound whose intensity level is 70 dB has intensity:
a) 10^{-5} Wm^{-2} b) 10^{-8} Wm^{-2}
c) 10^{-7} Wm^{-2} d) 10^{-6} Wm^{-2}

23. The shape of Cochlea is like:
a) circular b) snail
c) triangle d) rectangular

24. The maximum limit of audible frequency range is:
a) 25,000 Hz b) 20,000 Hz
c) 15,000 Hz d) 18,000 Hz

25. The minimum limit of audible frequency range is:
a) 10 Hz b) 15 Hz
c) 5 Hz d) 20 Hz

26. The baby can hear sound of frequency:
a) 20,000 Hz b) 15,000 Hz
c) 10,000 Hz d) 18,000 Hz

27. Ultrasonic wave have frequency more than. (G-II/2005)
a) 20,000 Hz b) 15,000 Hz
c) 10,000 Hz d) 18,000 Hz

28. The silent whistle can be hear by:
a) human b) dogs
c) monkey d) cats

29. Ultrasonic is used in medical field for:
a) diagnosing b) curing
c) scaling of teeth d) all of these

30. Ultrasonic are used:
a) to find depth of sea
b) to find crack in machinery
c) to find oil source under earth
d) all of these

31. Musical sounds are produced by:
a) flute b) voilen
c) harmonium d) all of these

32. Audiable sound have frequency range:
a) 20 Hz to 20,000 Hz
b) 10 Hz to 20,000 Hz
c) 20,000 Hz to 25,000 Hz
d) 25,000 Hz to 30,000 Hz

33. The dogs have audible frequency range:
a) 10 Hz to 20,000 Hz
b) 20,000 Hz to 25,000 Hz
c) 26,000 Hz
d) more than 25,000 Hz

34. The hair like structure in cochlea is called:
a) Optic nerves b) brain nerves
c) Common nerves
d) auditory nerves

35. Loudness of sound depends, upon factors.
a) 1 b) 2
c) 3 d) 4

36. Ear has parts.

a) 1 b) 2
c) 3 d) 4

37. Frequency of waves having wavelength 2 m and velocity 340 ms^{-1} is: (L.B'04)-I

a) 1020 Hz b) 680 Hz
c) 170 Hz d) 340 Hz

38. Sound level of average whispering is equal to: (L.B'05)-II

a) 30 dB b) 20 dB
c) 10 dB d) 0 dB

39. 1 bel. is equal to. (G-I/2006)

a) 5 dB b) 10 dB
c) 15 dB d) 20 dB

40. Unit of intensity of sound is:

a) wm^{-1} b) wm^{-2}
c) wm^{-3} d) wm

41. The speed of sound can be found by using the formula:

a) v=4f b) v=4f/
c) $v=4\frac{f}{l}$ d) $v=\frac{l}{4f}$

42. Sound Energy flowing per second through a unit area held perpendicular to the direction of sound wave is called: (L.B' 10)

a) loudness of sound
b) pitch of sound
c) intensity of sound
d) quality of sound

ANSWERS

1.	b	2.	c	3.	b	4.	d	5.	c	6.	d	7.	a
8.	d	9.	a	10.	b	11.	a	12.	d	13.	a	14.	c
15.	b	16.	b	17.	c	18.	b	19.	a	20.	c	21.	c
22.	a	23.	b	24.	b	25.	d	26.	a	27.	a	28.	b
29.	d	30.	d	31.	d	32.	a	33.	b	34.	d	35.	c
36.	c	37.	c	38.	b	39.	b	40.	b	41.	b	42.	c

SHORT ANSWERS

1. Of what kind sound waves are produced by tuning fork?

Ans. With the vibration of tuning fork compressional waves are produced, because it vibrate about its mean position.

2. How sound is produced in laboratory?

Ans. Sound is produced in laboratory with the tuning fork by striking it to the rubber pad due to which vibrations are produced and sound is generated due to vibrations.

3. Define Compression.

Ans. When the prongs of tuning fork move right and exert pressure on the layer of air. This pressure due to which air particles are compressed is called compression.

4. What do you mean by rarefaction?

Ans. When the prongs of tuning fork move toward left the pressure on the layer to the right is less due to this rarefaction is produced.

5. How is sound produced?

Ans. Sound can be generated by the vibration of the body.

6. Is any medium required for propagation of sound?

Ans. Yes, any material medium is required for propagation of sound, i.e. solid, liquid and gas.

7. Write the name of characteristic of sound.

Ans. There are five characteristic of sound.

i) Loudness of sound ii) Intensity of sound iii) Pitch
iv) Quality of sound v) Music and noise

8. Define loudness:

Ans. It is characteristic of sound due to which we can distinguish between louder and fainter sound is called loudness.

9. What do you mean by intensity of sound?

Ans. Energy flowing per second through a unit area held perpendicular to the direction of sound waves is called intensity of sound.

10. Define pitch.

Ans. It is the characteristic of sound due to which a shrill and grave sound can be distinguished is called pitch. It depends upon frequency.

11. Define the quality of sound.

Ans. The characteristic of sound due to which two sounds of same loudness and pitch are distinguished from each other is called quality. It depends upon wave form

12. Distinguish between noise and musical sound. (G-I/2006)

Ans. The sound which has pleasant effect on ear is called musical sound. The sound which has jarring effect is called noise. The frequency and amplitude of musical sound change in a regular manner.

The frequency and amplitude of noise change in an irregular manner.

13. What is audible frequency range? (G-I/2007)

Ans. We can hear the sound of frequency lying between 20 Hz to 20,000 Hz. This is called audible frequency range.

14. What is meant by ultrasonic? Give its two uses. (L. B '10)

Ans. The sound waves which have frequency more than 20,000 Hz is called ultrasonic. Uses:

(1) It helps us in industry to find cracks in machinery.

(2) Depth of an ocean can also be measured by using ultrasonics.

15. How can we find speed of sound? Write its formula.

Ans. With the help of resonance tube we can determine the speed of sound. The formula used to calculate speed of sound is $v = 4fl$.

16. How you can explain that greater the surface area greater is sound?

Ans. Greater the surface area of vibrating body greater is the sound produced. For example the bell of school has greater area, so its sound is louder while the bell used in home has less area so fainter sound is produced.

17. Write about the hearing process.

Ans. Sound is accepted by external ear and sends it to the eardrum. Oval window accept these vibration and send it to the cochlea in the inner ear, from here these waves are sent to brain through auditory nerves.

18. What is meant by resonance?

Ans. The phenomena in which there is remarkable increase in amplitude and hence loudness of the sound when the frequency of air column becomes equal to that turning fork is called resonance.

19. What is silent whistle?

Ans. Some people use silent whistle to call dogs whose frequency lies between 20,000 Hz to 25,000 Hz. It is silent for human but not for dogs because their audible frequency range is much more than humans audible frequency range.

20. Name three parts of human ear. (G-II/2006)

Ans. (i) Outer ear (ii) Middle ear (iii) Inner ear